

## Career Highlights

- ***Firmware Engineer, Enlighted Inc. (Siemens) 2019-current***

- Acted as Director of Firmware
- Architected and implemented new IoT on-premise edge platform, using Docker, Python, C; integrated with existing infrastructure
  - Used by 3+ custom integrations for major clients, and multiple internal purposes
  - Saved \$1M/year in license fees vs. alternative platform
  - Released as new product, "Enlighted Edge," January 2023
  - Provisional patent application for Enlighted Edge, January 2023
- Had primary responsibility for critical Enlighted Gateway embedded product, which routes wireless data from all switches, lighting sensors, and BLE location tags, to the Enlighted Energy Manager
  - Prepared multiple production releases of Gateway firmware (C, Buildroot)
  - Performed port of Gateway product to AWS IoT
  - Performed diagnostics and fixes for critical customer issues and enhancements
- Developed virtual test environment for Enlighted sensors
- Diagnosed internal and customer hardware and firmware issues
- Developed secure pairing mechanisms for GUI-less Enlighted sensors
- Supported 3rd Party Integration and Data Science teams
  - Built stand-alone ESP32-CAM based camera for people counting analysis
- Was second Enlighted Canada employee; Interviewed 15 subsequent employees for Enlighted Canada office (now at over 70 people)
- Interviewed, selected, mentored co-op students on Gateway work (8 total)
  - Used Agile process daily

- ***Contract work, Personal Projects (Nova Scotia) 2003-2019***

- Customized VOIP installations (customers included ProtoCase)
- Ported commercial/military GPS product to handheld platform
- Performed due diligence and troubleshooting for investment firm's portfolio companies
- Developed several low-power electronic product prototypes
- Ported legacy Windows application to an open-source SAAS model

- ***Founded IronSentry.com (Halifax) 2001-2003***
  - Patented technology to seamlessly archive, index, and search email (in pre-Gmail era)
  - Secured \$500K seed funding
  - Grew to six employees in Halifax
- ***Founded PhotoPoint.com (Halifax) 1998-2001***
  - Developed original, patentable technology
  - Secured \$43M investment from Softbank, USVP
  - Top 100 Internet site, millions of photos served daily
  - Largest photo sharing site 1998-2001, millions of members
  - Licensed code to Intel (\$1.7M) for GatherRound.com
  - Licensed code to Epson (\$1M) for Epson Photo Center (still in operation)
  - Developed and integrated E-commerce infrastructure for prints, merchandise
  - Led 75 employees in Halifax in development, tech, hosting, web, content
  - Led 25 employees in San Francisco in sales, marketing, P.R.
  - Retained majority of jobs in Canada, despite US funding
  - Developed and maintained a high reliability, highly scalable, secure web server infrastructure with redundant connectivity, auxiliary power
- *Ernst & Young Entrepreneur of the Year Award 2000, Emerging Technologies*
- *Halifax Chamber of Commerce Bronze Award 2000, Best New Business*
- *Atlantic Progress Magazine Top 50 CEO's 2000*
- *Sun Microsystems Java Cup Programming Contest: First place, Web category (\$40,000 prize)*
- ***MKS, Inc (Waterloo), 1990-1998:***
  - Team Leader and architect for flagship product, *MKS Toolkit*
  - Developed *MKS Web Integrity* prototype
  - Developed *MKS Internet Anywhere* communications product
- ***IBM (Toronto), 1989-1990***
  - Ensured ANSI standards compliance for IBM's C compiler
- Contributed code to security-focused *Qubes* operating system
- Expert witness in FBI federal wire fraud case resulting in conviction and life term
- Instructor for required 3<sup>rd</sup> year Computing Science course, Dalhousie University
- Regular speaker at InnovaCorp tech. meetups

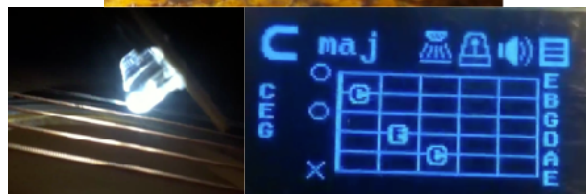
## Skills

- Strong design and architecture talent
- Extensive understanding of electronics:
  - Analog and digital electronics design
  - Development of efficient, low-power, low-cost devices
  - Development of drivers for various displays, peripherals
  - Experience with various microprocessor architectures (ARM, ATmega, AVR, Pic, x86, Nordic N52840, and others)
  - Linux, Buildroot, FreeRTOS, bootloaders, and bare metal
  - Fluent in with a variety of languages for embedded systems (assembler, machine code, C, C++, Lua, uPython, Forth, and more)
  - Experienced with microcomputer protocols (UART, SPI, I2C/TWI, 1-Wire, RF24, and more)
  - Reading and application of data sheets, specifications
- Experience with wide variety of programming languages, operating systems, databases, VM technologies, web serving and networking protocols, security methodologies, and encryption algorithms
- Extensive Python experience
- Strong networking, Web, HTML, Java experience
- 3D design, 3D printing, schematics, PCB design
- Abilities with low-level operating system abilities (e.g. device driver development)
- Optimization, debugging, troubleshooting, diagnostics
- Knowledge of machine learning, AI, neural networks
- Development of business plans, financial models
- Strong writing and presentation

Moped Dashboard  
Computer



Optical Guitar Tuner  
with Chord Generator



# Product Example - The Carbon Keyboard

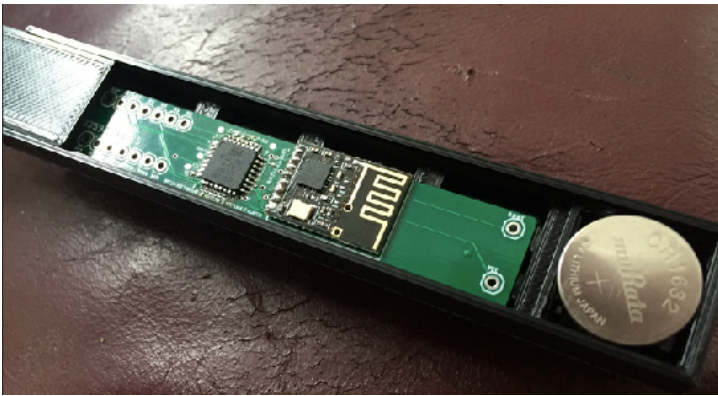
I have designed a variety of low-power electronic gadgets, but custom mechanical keyboard design has become my latest fascination.

In experimenting with mechanical keyboards, I eventually found the rectangular "ortholinear" arrangement of keys to be far more natural and ergonomic than the traditional left-leaning staggered layout. However, adjusting to the ortholinear layout can take some time and effort.

As well, in the mechanical keyboard world, there are a variety of designs (60%, 40%, and variants), which typically use fewer rows than a traditional 104-key keyboard--using additional shifts to access Fn keys and/or numeric keys, for example.

I wondered if I could create a single keyboard design that could be reconfigured to any of 100%, 60%, 40% (or other), staggered or ortholinear, with or without Fn keys and numeric keypad, with optional extra CAD keys or presenter remotes, and so forth--the Lego-block of keyboard design. Without any messy wires and unreliable connectors.

So I created a low-power, 6-key, wireless, encrypted keyboard module, the "Carbon."

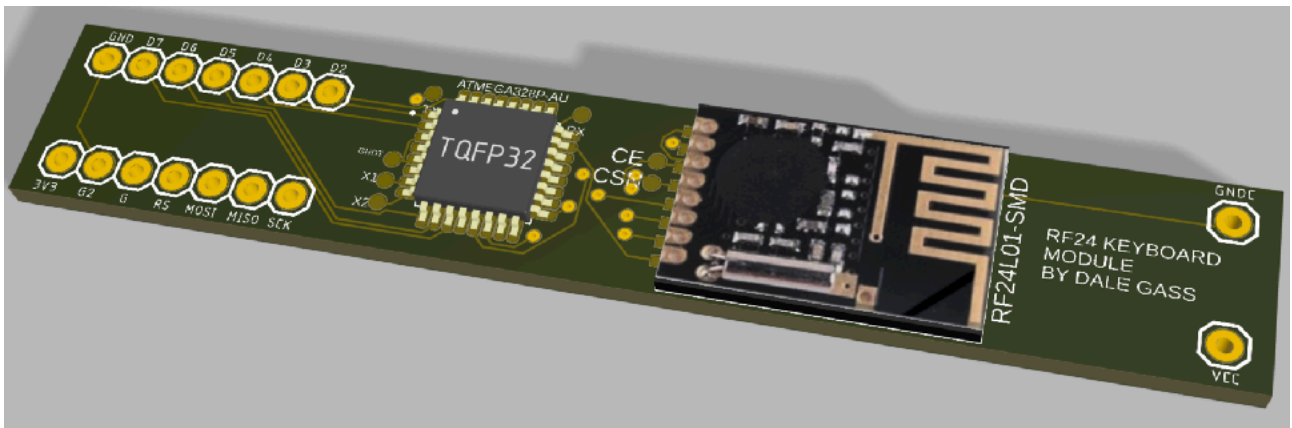


These low profile six-key modules can be combined into full keyboards of any size, as well as being arranged in either staggered or ortholinear arrangements. Just by sliding the modules, one can gradually adapt to the more ergonomic ortholinear style.



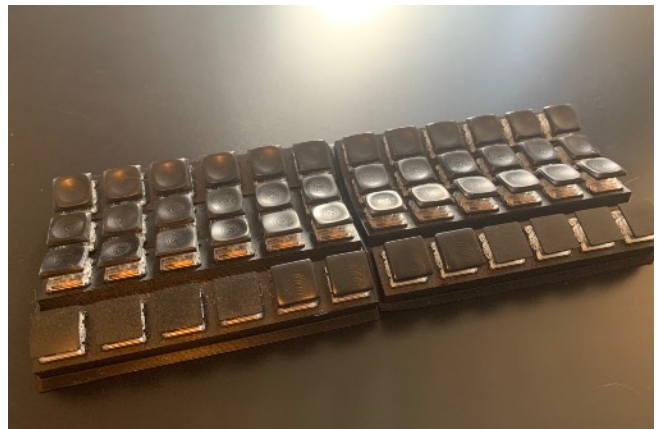
The Carbon name was inspired by the element with atomic number 6, that can be combined into an infinite variety of organic configurations. It has been my sole work/personal keyboard for over two years.



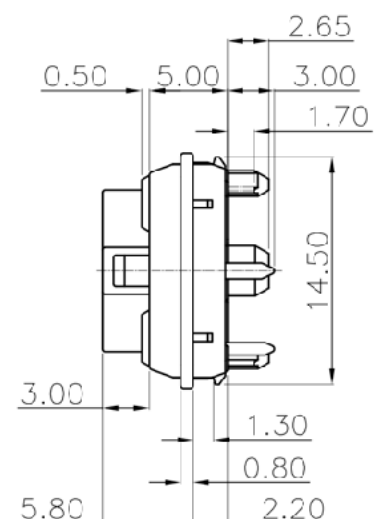


## Features

- Fully customizable; can take on any style: traditional 104 key QWERTY, 60%, 40%, etc.
- Keyboard module PCB's can be used with a variety of key switches and cases
- Can be single fully keyboard (magnetically or physically attached), or split
- Easy to add on numeric pad, Fn keys, and wireless presenter remote
- Up to 256 modules can be laid out arbitrarily, with fully flexible key assignments
- Modules are 19mm x 114mm, so can be stacked flush and without gaps to achieve a traditional 19mm row spacing, or full keyboard width
- Low profile, just 16mm high, including key cap
- Keyboard modules can be easily removed from their trays, providing ease of cleaning, and ease of key cap swapping
- Simple construction, with just a coin cell, PCB, seven key wires (6+GND) per module, no diodes!
- Strong encryption
- Low power: battery life of 15 years standby, 5-10 million keystrokes
- USB Dongle is an Arduino Micro with RF24 Module, running custom firmware
- Hard case protects the keyboard in your pocket or backpack, stores USB dongle
- Keyboard module code is highly optimized; Just 3k including deep sleep, RF transmission, and encryption; uses no 3rd party libraries
- Keyboard dongle code is similarly efficient, 300 lines of customizable Arduino code
- Provides a virtual USB serial port for configuration interface
- Prototype uses Kailh Choc White, slim profile, tactile key switches.



Carbon modules with sculpted keycaps and a curved base



# High Speed 1-Wire Variant

I have made several custom keyboards. My "daily driver" keyboard for a year was a split, 6x4 layout, Cherry Blue switches, DSA key caps, with a custom, optimized high-speed 1-Wire variant used for communications between USB interface (Arduino Micro), and the keyboard halves.



I initially attempted using 1-Wire itself for communications, but it was too slow to poll. So I created a custom equivalent to 1-Wire that uses a 500 kbps data rate, and only a single byte address which boosted speed significantly. Polling rate is now 1000x/sec.

Power and data are both sent over the shared two wires, which have magnetic connectors (for convenience, and ensuring proper polarity of connections.)

The keyboard halves attach to each other, or or can be joined by a long two-wire connection with magnetic ends, avoiding cable fatigue issues. (Additional keyboard or mouse modules could be magnetically added on the two-wire bus.)

The USB host interface device is simply an Arduino Micro, with two magnets and one resistor. It can connect magnetically to different attachment points on the keyboard, which assists with cable management, and protects against cable strain/stress.

Any short or polarity reversal is sensed, and a flashing light on the Arduino indicates the problem without allowing any damage.

I've had used this as my main keyboard for over a year, and it has proven extremely comfortable and reliable.



## Other Designs

I have created various other designs and concepts, such as magnetically swappable keycaps, and various ortho/staggered sliding and splitting mechanisms.

